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(54) Title: FOOD COATING COMPOSITION CONTAINING A FILM-FORMING AND A HYDROPHOBIC COMPONENT

(57) Abstract

A composition is provided which when incorporated in a batter mix minimizes the loss in crispness which usually develops in batter-coated foods which are precooked, then stored frozen, thawed and reheated in a microwave oven. The composition comprises a film forming composition to impart a crisp surface to cooked foods. Bread crumbs impregnated with a crispness improving composition, for example, proteins, are also provided. Also provided are processes for preparing the bread crumbs and processes for using the bread crumbs to impart a crisp surface to foods upon cooking.

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FOOD COATING COMPOSITION CONATINING A FILM-FORMING AND A HYDROPHOBIC COMPONENT

The present invention relates to a coating composition for foods which produces a crisp coating when cooked. More particularly, the present invention relates to a coating composition which produces a crisp coating when applied to foodstuffs which are cooked, for example, in a microwave oven.

These foodstuffs can be prepared for oven cooking by coating them with a flour/starch batter, optionally followed by a breading material. The coated product is then subjected to deep-fat flash frying at about 375°F and then re-frozen. The pre-frying step is sufficient to at least partially cook the coating ingredients.

The widespread use of microwave ovens, now a standard feature in many homes and restaurants, has increased the demand for the time-saving "ready to heat" frozen food products now on the market. However, frozen food comestibles cooked in a microwave oven do not always exhibit desirable characteristics comparable to those of fried or baked foods.

During conventional oven cooking or frying of a batter-coated food, the exterior of the food receives the most heat. This drives moisture out of the coating, resulting in a crisp outer surface. This is not the case in a microwave oven, however. Absorption of microwave energy by water is mainly responsible for microwave heating of a food. Microwave radiation penetrates deeply into the food, heating all liquid water within the zone of penetration and resulting in fairly uniform heating within this zone. Heat and steam generated within the food drive water vapor to the surface, where it can cause the coating to become soggy.

Oil contained in the coating of a prefried food can also absorb microwave radiation. In the absence of water, this could heat the coating to high temperatures. However, the constant flux of water vapor generated within the food and driven outward keeps the moisture content of the coating high, and vaporization of water at the surface keeps its temperature low, with the result that the coating becomes soggy.

In addition to the above disadvantages of microwave cooking of pre-fried frozen foods, it must also be taken into account that convenience foods are normally produced and packaged to have a shelf life of about three months to a year. During this time period, storage temperatures may fluctuate widely causing the food to undergo one or more partial or complete freeze/thaw cycles during transportation and storage. This has a deleterious effect since absorption of moisture condensed on the

surface often results in a soggy food piece. Freeze/thaw stability of a product is a serious concern in the frozen food industry.

Microwave crispness and/or stability maintenance agents are referred to in a number of patents.

United States patent number 4,529,607 issued on July 16, 1985 and United States Patent number 4,595,597 issued on June 17, 1986 refer to a batter mix containing about 50 to 80 percent high amylose flour which is used to coat a pre-fried microwaveable foodstuff.

United States Patent number 4,778,684 issued on October 18, 1988 and United States Patent number 4,842,874 issued on June 27, 1989 refer to a dry product suitable for coating a food piece prior to batter application. The product is a composition comprising greater than 20 percent by weight of a hydroxypropylmethyl cellulose ether having a methoxyl context greater than 22 percent and a hydroxypropyl content of at least 5 percent by weight.

United States Patent number 4,199,603 refers to an edible oil containing a moisture absorbing substance such as pregelatinized starch which is used to coat a frozen food piece. After coating, a hygroscopic crisp particulate, such as a bread crumb, is applied to the food piece.

Patent Ccoperation Treaty (PCT) application number W092/01384 published February 6, 1992 refers to a dry batter mix containing high amylose flour and a cellulose derivative.

United States Patent number 4,675,197 issued June 23, 1987 refers to a method of coating foodstuffs which comprise predusting with powdered albumen and particulated high density bread crumbs, coating with a batter, and then coating with particulate low density bread crumbs.

United States Patent Number 4,068,009 issued January 10, 1978 refers to a bread crumb coating composition wherein the bread crumbs consist of wheat flour, yeast and salt and have an elongated, porous and striated shape and structure.

United States Patent number 4,661,359 issued April 28, 1987 refers to an edible film coating comprising shellac and hydroxypropyl cellulose or hydroxy propyl methyl cellulose.

United States Patent number 4,367,242 issued January 4, 1983 refers to a roast poultry coating mix containing gelatin, shortening, dextrin and starch.

United States Patent number 4,588,600 issued May 13, 1986 refers to a coating premix composition comprising a farinaceous material, and a plastic shortening or fat.

United States Patent number 4,640,837 issued February 3, 1987 refers to a coating composition comprising a bread crumb/oil blend, maltodextrin, soy protein concentrate and pre-gelatinized starch.

United States Patent number 4,504,502 issued March 12, 1985 refers to a method for producing a coated food product by first applying a water soluble algin followed by cooking.

United States Patent number 4,293,572 issued October 6, 1981 refers to a process for uniformly coating a food by applying a water-in-oil emulsion comprising a dispersion of a solution of a saccharide, polysaccharide or dextrin in water in an oily substance.

United States Patent number 4,260,637 issued April 7, 1981 refers to a self-sticking bread crumb comprising bread crumbs of a specified particle size with a protein adhesive on the surface.

United States Patent number 4,218,485 issued August 19, 1980 refers to a process for imparting a fried taste to a baked comestible by coating a moistened comestible with a dry coating material comprising striated bread crumbs, corn flour, rice flour and a binding agent containing a starch and dextrin.

United States Patent number 4,208,412 issued June 27, 1980 refers to a coating composition comprising bulking agents containing crumbs, a protein and a leavening agent.

United States Patent number 4,188,410 issued February 12, 1980 refers to a comestible which may be coated with an emulsifier which foams during frying.

United States Patent number 4,414,237 issued November 8, 1983 refers to a process for preparing a sauce having a pulpy texture with the texture provided by pulp-stimulating particles comprising bread crumbs having a striated shape.

United States Patent number 4,375,484 issued March 1, 1983 refers to a frozen batter having a continuous aqueous phase containing flour and a gum and a discontinuous fat phase.

United States Patent Number 4,440,793 issued April 3, 1984 refers to a method for producing bread crumbs containing 0.5-6.0% soy bean protein.

Canadian Patent Number 1190786 issued July 23, 1985 refers to a composition for providing a moisture resistant coating on a food product, comprising shellac, a prolamine (e.g. zein), a cellulose plasticizer and a solvent.

Great Britain Patent Number 2084849A issued April 21, 1982 refers to stabilization of cake crumbs against moisture pickup from dessert filling by coating with fat.

United States Patent Number 4,640,387 issued February 3, 1987 refers to a food coating composition for imparting a crisp brown surface to foodstuffs cooked in a microwave, comprising bread crumbs, oil, dextrin, starch and a soy protein isolate.

United States Patent Number 4,877,629 issued October 31, 1989 and United States Patent Number 4,448,608 issued August 14, 1990 refer to a process for preparation of coated macerated chicken or beef wherein a barrier mixture containing starch, methyl cellulose and xanthan gum, and a flour-water batter are applied.

United States Patent Number 4,963,375 issued October 16, 1990 refers to a food coating comprising, a coagulant in a water immiscible liquid and a crisping agent.

European Patent Application 0319287 refers to foodstuff comprising a bakery component containing more than 30% heat set proteins.

In one embodiment, the present invention is directed to an edible food coating composition comprising

(a) from about 50 to about 95 weight percent of a film forming composition, and

(b) from about 5 to about 50 weight percent of a hydrophobic composition, said coating composition when incorporated in a batter mix imparting a crisp surface to foods upon cooking of said foods.

Preferred is the composition wherein said film forming composition is present at from about 50 to about 90 percent by weight.

Especially preferred is the composition wherein said hydrophobic composition is present at from about 10 to about 25 percent by weight.

Also preferred is the composition wherein said film forming composition is selected from the group consisting of hydroxypropyl methylcellulose, hydroxypropylcellulose, methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and

zein; and combinations thereof with a preferred film forming composition being hydroxypropyl methylcellulose.

Also preferred is the composition wherein said hydrophobic material is selected from the group consisting of fats, fatty acids, waxes and petroleum waxes; and combinations thereof; with preferred fatty acids selected from the group consisting of stearic acid and palmitic acid; and combinations thereof, with a preferred wax being carnauba wax.

Further preferred is the composition further comprising a water binding composition.

Especially further preferred is the composition wherein said water binding composition is present at a concentration of from about 0.01 to about 30 weight percent with an especially preferred concentration being from about 2 to about 5 weight percent.

Especially further preferred is the composition wherein said water binding composition is selected from the group consisting of soluble carbohydrates, insoluble carbohydrates, polyols, proteins, inorganic salts, organic acids, salts of organic acids; and combinations thereof; with an especially preferred water binding composition being guar gum.

Further preferred is the composition further comprising a plasticizer with a preferred composition being one wherein said plasticizer is present at a concentration of from about 0.01 to about 15 weight percent especially from about 7 to about 12 percent.

Also further preferred is the composition wherein said plasticizer is selected from the group consisting of glycerol, propylene glycol and polypropylene glycol; and combinations thereof; with an especially preferred plasticizer being propylene glycol.

Further preferred is the composition further comprising an emulsifier with a preferred composition being one wherein said emulsifier is present at a concentration of from about 0.01 to about 15 weight percent, especially from about 1 to about 12 weight percent.

Further especially preferred is the composition wherein said emulsifier is selected from the group consisting of propylene glycol, lecithins, monoglycerides, diglycerides, diacetyltartaric acid esters of monoglycerides, diacetyltartaric acid esters of diglycerides, monosodium phosphate derivatives of monoglycerides, monosodium

phosphate derivatives of diglycerides, polyol fatty acid esters, sorbitan fatty acid esters, polyoxyethylene monoglycerides, polyoxyethylene diglycerides, polyoxyethylene sorbitan fatty acid esters, sucrose fatty acid esters, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty acids, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty alcohols, esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic, or succinic with monoglycerides, and esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic or succinic with diglycerides; and combinations thereof.

Further preferred is the composition further comprising a viscosifying agent.

Especially further preferred is the composition wherein said viscosifying agent is present at a concentration of from about 0.01 to about 15 percent by weight, especially at from about 0.05 percent to about 5 percent by weight.

Also especially preferred is the composition wherein said viscosifying agent is selected from the group consisting of xanthan gum, guar gum, starches, gelatin, pectin, agar, carrageenans, alginates, locust bean gum, methyl cellulose, hydroxypropylcellulose, hydroxypropylmethyl cellulose, carboxymethyl cellulose, ethyl cellulose and methylethyl cellulose; and combinations thereof.

Also preferred is a batter mix containing a coating composition of the present invention.

Also preferred is a foodstuff coated with the batter mix, said foodstuff selected from the group consisting of meats, poultry, baked goods, fish, vegetables and cheeses.

In another embodiment, the present invention is directed to a process for imparting a crisp surface to a foodstuff comprising

(a) applying a crisping composition to said foodstuff, said crisping composition comprising

(i) from about 50 to about 95 weight percent of a film forming composition, and

(ii) from about 5 to about 50 weight percent of a hydrophobic composition, said crisping composition incorporated into a batter mix, and

(b) cooking said foodstuff.

Especially preferred is the process wherein said film forming composition of said crisping composition is present at from about 50 to about 90 percent by weight.

Also preferred is the process wherein said hydrophobic composition of said crisping composition is present at from about 10 to about 25 percent by weight.

Especially preferred is the process wherein said film forming composition of said crisping composition is selected from the group consisting of hydroxypropyl methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and zein; and combinations thereof with an especially preferred film forming composition being hydroxypropyl methylcellulose.

Especially preferred is the process wherein said hydrophobic material of said crisping composition is selected from the group consisting of fats, fatty acids, waxes and petroleum waxes; and combinations thereof, with an especially preferred fatty acid selected from the group consisting of stearic acid and palmitic acid; and combinations thereof; with an especially preferred wax being carnauba wax.

Further preferred is the process wherein said crisping composition further comprises a water binding composition with an especially preferred concentration of said water-binding composition of from about 0.01 to about 30 weight percent, especially from about 2 to about 5 weight percent.

Preferred is the process wherein said water binding composition of said crisping composition is selected from the group consisting of soluble carbohydrates, insoluble carbohydrates, polyols, proteins, inorganic salts, organic acids, salts of organic acids; and combinations thereof; with an especially preferred water binding composition being guar gum.

Further preferred is the process wherein said crisping composition further comprises a plasticizer at an especially preferred concentration of said plasticizer of from about 0.01 to about 15 weight percent, especially of from about 7 to about 12 percent.

Especially further preferred is the process wherein said plasticizer of said crisping composition is selected from the group consisting of glycerol, propylene glycol and polypropylene glycol; and combinations thereof; with an especially preferred plasticizer being propylene glycol.

Further preferred is the process wherein said crisping composition further comprises an emulsifier with an especially preferred concentration of said emulsifier of from about 0.01 to about 15 weight percent, especially of from about 1 to about 12 weight percent,

Further especially preferred is the process wherein said emulsifier of said crisping composition is selected from the group consisting of propylene glycol, lecithin, monoglycerides, diglycerides, diacetyltartaric acid esters of monoglycerides, diacetyltartaric acid esters of diglycerides, monosodium phosphate derivatives of monoglycerides, monosodium phosphate derivatives of diglycerides, polyol fatty acid esters, sorbitan fatty acid esters, polyoxyethylene monoglycerides, polyoxyethylene diglycerides, polyoxyethylene sorbitan fatty acid esters, sucrose fatty acid esters, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty acids, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty alcohols, esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic, or succinic with monoglycerides, and esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic or succinic with diglycerides; and combinations thereof.

Especially preferred is the process wherein said foodstuff is selected from the group consisting of meats, poultry, baked goods, vegetables and cheeses.

In another embodiment, the present invention is directed to a bread crumb composition which when applied to a food surface prepared to receive said crumbs imparts a crisp surface to said food upon cooking, said bread crumb composition comprising a bread crumb impregnated with a crispness improving composition, with preferred crispness improving composition selected from the group consisting of proteins, gelatin, flour, starches, dextrins, waxes, shellac and polysaccharides; and combinations thereof.

Preferred is the bread crumb composition wherein said crispness improving composition is a protein selected from the group consisting of whey proteins, corn proteins, rice proteins, wheat proteins, and animal proteins; and combinations thereof with especially preferred proteins being whey protein, wheat protein, and egg albumen, optionally with said proteins being denatured by heating.

Also preferred is the bread crumb composition wherein said crispness improving agent is shellac.

Also preferred is the bread crumb composition wherein said crispness improving agent comprises gelatin and one or more proteins.

Also preferred are batter mixes, and foodstuffs containing the bread crumb composition of the present invention.

Further preferred is a bread crumb composition further comprising a fat or an oil.

In yet another embodiment, the present invention is directed to a method for improving the crispness of bread crumbs comprising

(a) treating said crumbs with an aqueous solution or dispersion of a crispness improving composition.

(b) substantially drying the treated crumbs,

(c) applying said treated crumbs to a food, and

(d) cooking said food.

Preferred is the method wherein said crispness improving composition is selected from the group consisting of proteins, gelatin, flour, starches, dextrins, waxes, shellac and polysaccharides, and combinations thereof.

Further preferred is the method wherein said crispness improving composition further comprises a fat or an oil.

In still another embodiment, the present invention is directed to a process for imparting a crisp surface to a foodstuff comprising

(a) preparing a surface of a foodstuff to receive a bread crumb composition;

(b) applying a bread crumb composition to said surface, said bread crumb composition comprising a bread crumb impregnated with a crispness improving composition; and

(c) cooking said foodstuff.

Preferred is the method wherein said crispness improving composition is selected from the group consisting of proteins, gelatin, flour, starches, dextrins, waxes, shellac and polysaccharides; and combinations thereof.

Further preferred is the method wherein said crispness improving composition further comprises a fat or an oil.

In still another embodiment, the present invention is directed to a method for imparting a crisp surface to a foodstuff comprising

(a) preparing a surface of said foodstuff to receive a bread crumb composition;

(b) applying a bread crumb composition to said surface;

(c) treating said food with an aqueous solution or dispersion of a crispness improving composition; and

(d) cooking said food.

Preferred is the method wherein crispness improving composition is selected from the group consisting of proteins, gelatin, flour, starches, dextrins, waxes, shellac, and polysaccharides, and combinations thereof.

Further preferred is the method wherein said crispness improving composition further comprises a fat or an oil.

In still another embodiment, the present invention is directed to a process for imparting a crisp surface to a battered, breaded, or battered and breaded food comprising

(a) cooking or partially cooking said foodstuff;

(b) treating said food with an aqueous solution or dispersion of a crispness improving composition, and

(c) substantially drying the surface of said foodstuff.

Preferred is the process wherein said crispness improving composition comprises one or more substances selected from the group consisting of proteins, flour, starches, dextrins, gelatin, shellac, waxes, and polysaccharides; and combinations thereof.

Also preferred is the process wherein said crispness improving composition comprises a starchy composition and a film-forming composition, with especially preferred starchy composition selected from the group consisting of rice flour, wheat flour, corn flour, potato starch, oat flour, caramelized barley malt, and corn starch, and combinations thereof, and especially preferred film forming compositions selected from the group consisting of hydroxypropyl methylcellulose, hydroxypropylcellulose, methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and zein; and combinations thereof.

Also especially preferred is the process wherein said crispness improving composition further comprises a composition selected from the group consisting of

tapioca dextrin, maltodextrins, polydextrose, and dextrose, and combinations thereof, with the also especially preferred process wherein said crispness improving composition further comprises a fat or an oil.

The food coating composition of the present invention, when incorporated in a batter mix, imparts a crisp surface to foods upon cooking of said foods. The composition of the present invention is especially preferred for use on foods which are precooked, e.g. by frying in oil or baking in a conventional oven, then stored frozen, thawed, and reheated in a microwave oven. The loss in crispness usually observed under such conditions, resulting from moisture pickup by the coating during storage, thawing and reheating, is greatly diminished through use of the present composition.

The food coating composition comprises from about 50 to about 95, preferably from about 50 to about 90 weight percent of a film forming composition and from about 5 to about 50, preferably from about 10 to about 25, weight percent of a hydrophobic composition.

While not wishing to be bound by theory, we believe that the composition of the present invention, when incorporated into a batter, upon cooking forms a barrier within said batter which inhibits absorption of moisture, thereby preventing sogginess. While the exact nature of the barrier is unknown, it may bear some similarity, on a microscopic scale, to lipid-hydrocolloid bilayer films described, for example, by Kester and Fennema in the Journal of Food Science, volume 54, pages 1383-1389, 1989, and in references cited therein. The prior art bilayer films, however, are formed as discrete films, whereas the moisture barriers believed operable in the present invention are formed in the presence of other ingredients of a batter mix.

Non-limiting examples of film forming compositions are hydroxypropyl methylcellulose, hydroxypropylcellulose, methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and zein; and combinations thereof, with an especially preferred film forming composition being hydroxypropyl methylcellulose.

Non-limiting example of hydrophobic compositions are fats, fatty acids, waxes and petroleum waxes; and combinations thereof.

Preferred fatty acids are stearic and palmitic acid; and combinations thereof.

An especially preferred wax is carnauba wax.

If desired, a water binding composition may also be added to the composition of the present invention. If added, the water-binding composition is present at a concentration of from about 0.01 to about 30, preferably from about 2 to about 5 weight percent of the composition.

Non-limiting examples of water binding compositions are soluble carbohydrates, insoluble carbohydrates, polyols, proteins, inorganic salts, organic acids, salts of organic acids; and combinations thereof. An especially preferred water binding composition is guar gum.

If desired, a plasticizer may also be added to the composition of the present invention. If added, the plasticizer is present at a concentration of from about 0.01 to about 15, preferably from about 7 to about 12, weight percent.

Non-limiting examples of plasticizers are glycerol, propylene glycol and polypropylene glycol; and combinations thereof.

An especially preferred plasticizer is propylene glycol.

If desired, an emulsifier may also be added to the compositions of the present invention. If added, the emulsifier is present at a concentration of from about 0.01 to about 15, preferably from about 1 to about 12, weight percent.

Non-limiting examples of emulsifiers are propylene glycol, lecithins, monoglycerides, diglycerides, diacetyltartaric acid esters of monoglycerides, diacetyltartaric acid esters of diglycerides, monosodium phosphate derivatives of monoglycerides, monosodium phosphate derivatives of diglycerides, polyol fatty acid esters, sorbitan fatty acid esters, polyoxyethylene monoglycerides, polyoxyethylene diglycerides, polyoxyethylene sorbitan fatty acid esters, sucrose fatty acid esters, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty acids, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty alcohols, esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic, or succinic with monoglycerides, and esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic or succinic with diglycerides; and combinations thereof.

The present invention is also directed to a batter mix containing the composition of the present invention. The batter mix may be flour and water, or any other suitable batter mix.

Foodstuffs coated with the batter mix containing the composition of the present invention are also a part of the present invention.

Non-limiting examples of foodstuffs which may be coated with the batter mix of the present invention are meats, poultry, baked goods, fish, vegetables and cheeses.

In another embodiment, the present invention is directed to a process for imparting a crisp surface to a foodstuff comprising

(a) applying a crisping composition to said foodstuff, said crisping composition comprising

(i) from about 50 to about 95 weight percent of a film forming composition, and

(ii) from about 5 to about 50 weight percent of a hydrophobic composition, said crisping composition incorporated into a batter mix, and

(b) cooking said foodstuff.

In a preferred process of the present invention, the film forming composition of said crisping composition is present at from about 50 to about 90 percent by weight, with a preferred concentration of the hydrophobic composition at from about 10 to about 25 percent by weight.

Non-limiting examples of film forming compositions are hydroxypropyl methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and zein; and combinations thereof, with an especially preferred film forming composition being hydroxypropyl methylcellulose.

Non-limiting examples of hydrophobic compositions used in the crisping composition in the process of the present invention are fats, fatty acids, waxes and petroleum waxes; and combinations thereof; with a preferred fatty acid selected from the group consisting of stearic acid and palmitic acid; and combinations thereof.

An especially preferred wax is carnauba wax.

If desired the composition used in the process further comprises the addition of a water binding composition.

If added to the composition used in the process of the present invention, the water binding composition is present at a concentration of from about 0.01 to about 30, preferably at a concentration of from about 2 to about 5, weight percent.

Non-limiting examples of water binding compositions are soluble carbohydrates, insoluble carbohydrates, polyols, proteins, inorganic salts, organic acids, salts of organic acids; and combinations thereof.

An especially preferred water binding composition is guar gum.

If desired, the crisping composition used in the process of the present invention further comprises the addition of a plasticizer. If added, the plasticizer is present at a concentration of from about 0.01 to about 15, preferably from about 7 to about 12 weight percent. Non-limiting examples of plasticizers are glycerol, propylene glycol and polypropylene glycol; and combinations thereof. An especially preferred plasticizer is propylene glycol.

If desired, the crisping composition used in the process of the present invention further comprises the addition of an emulsifier. If added, the emulsifier is present at a concentration of from about 0.01 to about 15, preferably from about 1 to about 12 weight percent.

Non-limiting examples of emulsifiers are propylene glycol, lecithins, monoglycerides, diglycerides, diacetyltartaric acid esters of monoglycerides, diacetyltartaric acid esters of diglycerides, monosodium phosphate derivatives of monoglycerides, monosodium phosphate derivatives of diglycerides, polyol fatty acid esters, sorbitan fatty acid esters, polyoxyethylene monoglycerides, polyoxyethylene diglycerides, polyoxyethylene sorbitan fatty acid esters, sucrose fatty acid esters, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty acids, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty alcohols, esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic, or succinic with monoglycerides, and esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic or succinic with diglycerides; and combinations thereof.

The process may be used to coat any suitable foodstuff, with preferred foodstuffs being meats, poultry, baked goods, vegetables and cheeses.

In another embodiment, the present invention is directed to a bread crumb composition which when applied to a food surface prepared to receive said crumbs imparts a crisp surface to said food upon cooking. The bread crumb composition comprises a bread crumb impregnated with a crispness improving composition, with the crispness improving composition selected from the group consisting of proteins,

gelatin, flour, starches, dextrins, waxes, shellac and polysaccharides; and combinations thereof. The crispness improving composition can be applied to the bread crumbs before or after said crumbs have been applied to the food. In a further embodiment, the crispness improving composition can be applied to a battered and/or breaded food after said food has been cooked or partially cooked.

Preferred crispness improving compositions are proteins selected from the group consisting of whey proteins, corn proteins, rice proteins, wheat proteins, and animal proteins; and combinations thereof. Especially preferred proteins are whey protein, wheat protein, and egg albumen. The proteins may optionally be denatured by heating. An especially preferred crispness improving agent is shellac.

The present invention is also directed to a batter mix containing the bread crumb composition of the present invention. The batter mix may be flour/water or any suitable batter mix.

Preferred crispness improving compositions for treatment of cooked or partially cooked battered and/or breaded foods comprise a starchy composition and a film forming composition, with especially preferred starchy compositions selected from the group consisting of rice flour, wheat flour, corn flour, potato starch, oat flour, caramelized barley malt, and corn starch, and combinations thereof, and especially preferred film forming compositions selected from the group consisting of hydroxypropyl methylcellulose, hydroxypropylcellulose, methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and zein, and combinations thereof. If desired, said crispness improving compositions can further comprise a composition selected from the group consisting of tapioca dextrin, maltodextrins, polydextrose, and dextrose, and combinations thereof. If desired, said crispness improving composition can further comprise a fat or oil.

While not wishing to be bound by theory, we believe that the crispness improving composition of the present invention functions by supplementing the porous bread crumb or cooked batter structure with a rigid substance. The aqueous solution or dispersion of crispness improving composition with which the crumb or cooked batter is treated is absorbed into the body of the crumb or cooked batter. The crumb or cooked batter is then dried, removing most of the solvent and leaving the crispness improving composition as a crisp film within the structure of the crumb or cooked

batter. If the drying operation involves application of heat, heating of the treated crumbs or breading can promote processes, such as denaturation of proteins, involved in formation of a crisp, water-resistant structure. The drying operation can be a separate step or it can be accomplished during cooking or heating of the food carrying the treated batter or crumbs.

While not wishing to be bound by theory, we further believe that fats or oils, when included in the crispness improving compositions of the present invention, can function not only as moisture barrier materials, but also, because of their low heat capacity and low thermal conductivity relative to water, fats and oils can reach high temperatures which can promote processes involved in crisping such as, for example, denaturation of proteins.

It will be readily apparent to one skilled in the art that the aqueous solution or dispersion of the crispness improving composition can be applied by any convenient method including, for example, dipping, brushing, spraying, or application as a foam, etc.

It will further be apparent that, if desired, the aqueous solution or dispersion of the crispness improving composition can be formed on the surface of the food by applying the crispness improving composition as a dry powder, then applying the aqueous medium, for example by spraying.

If desired, the crispness improving composition of the present invention may also including colorants, flavorants or combinations thereof to impart desirable colors or flavors to foods treated with said compositions. For example, a caramel colorant can be included to impart a golden brown color to breaded chicken.

We have further surprisingly discovered by thermal imaging experiments that gelatin-protein films exposed to microwave radiation can reach temperatures well in excess of the boiling point of water. Although these experiments were carried out with discrete films which were not part of a food system, we believe that a similar mechanism may be operating to generate high temperatures within the treated crumbs of the present invention and that this mechanism may in some cases increase crumb crispness during microwave heating.

Having described the invention in general terms, reference is now made to specific examples. It is to be understood that these examples are not meant to limit the present invention, the scope of which is determined in the appended claims.

Example 1

Batter-Enrobed Chicken Tenders without Crisping Agent

A batter was made by adding 500 milliliters of water to 300 grams of dry batter mix (Newly Weds Foods Inc. B21545), and stirring to give a smooth batter. Pre-sized thawed chicken tenders (20-26 grams) were predusted by dredging in dry batter mix, then coated with batter by dipping into the batter and allowing the excess to drain. Breading (Newly Weds J Crumb #6001) was then applied by covering all sides of the tender with excess crumb, pressing lightly using hand pressure to firmly attach crumb, and gently shaking to remove excess crumb. The tenders were fry cooked in canola oil for 60-65 seconds at 375°F, drained, placed on paper towels, allowed to cool to room temperature for 15-20 minutes, and sealed into Ziploc® freezer bags. The bags containing tenders were put into two freezers, one maintained at 15°F, the other at 0°F. They were allowed to freeze, then stored frozen. Until the bags were completely frozen (24-48 hours), they were arranged to allow freezer air to contact all sides.

Example 2

Batter-Enrobed Chicken Tenders with Crisping Agent

Ingredient	Weight percent
Hydroxypropyl methylcellulose	72.5
Stearic acid	7.0
Palmitic acid	3.0
Guar	2.5
Carnauba wax	5.0
Propylene glycol	10.0
Total	100.0

A 13.4-gram portion of a dry blend of the ingredients was hydrated by stirring with 500 milliliters of water at 70°C for one hour. The resulting emulsion was added to 300 grams of dry batter mix (Newly Weds Foods Inc. B21545), and the mixture was stirred to give a smooth batter. Pre-sized thawed chicken tenders (20-26 grams) were predusted, then coated with the batter containing crisping agent by dipping into the batter and allowing the excess to drain. Breading (Newly Weds J Crumb #6001) was then applied by covering all sides of the tenders with excess crumb, pressing lightly using hand pressure to firmly attach crumb, and gently shaking to remove excess

crumb. The tenders were fry cooked in canola oil for 60-65 seconds at 375°F, drained, placed on paper towels, allowed to cool to room temperature for 15-20 minutes, and sealed into Ziploc® freezer bags. The bags containing tenders were put into two freezers, one maintained at 15°F, the other at 0°F. They were allowed to freeze, then stored frozen. Until the bags were completely frozen (24-48 hours), they were arranged to allow freezer air to contact all sides. At each test time, a bag was thawed, heated in a microwave oven, and evaluated for crispness by a trained 10-member panel against controls which had been prepared as described in Example 1 and stored, thawed, and heated under the same conditions. Crispness was rated on a scale of 0-9, with the controls assigned a score of 5.0. Results, given in the table below, demonstrate a statistically significant improvement in crispness for samples treated with the crisping agent.

Test temperature, °F	Time	Score
15	7 weeks	6.1
0	1 month	6.7
0	3 months	6.6
0	6 months	5.8

Example 3

Batter-Enrobed Chicken Tenders with Crisping Agent

Ingredient	Weight percent
Hydroxypropyl methylcellulose	70.0
Stearic acid	7.0
Palmitic acid	3.0
Locust bean gum	2.5
Xanthan gum	2.5
Carnauba wax	5.0
Propylene glycol	10.0
Total	100.0

A 13.4-gram portion of a dry blend of the ingredients was tested as described in Example 2. Results, given in the table below, demonstrate a statistically significant improvement in crispness for samples treated with the crisping agent.

Test temperature, °F	Time	Score
15	7 weeks	6.0
0	1 month	5.9
0	3 months	5.5
0	6 months	6.3

Example 4

Batter-Enrobed Chicken Tenders with Crisping Agent

Ingredient	Weight percent
Hydroxypropyl methylcellulose	70.0
Stearic acid	5.0
Palmitic acid	5.0
Guar	2.5
Iota carrageenan	2.5
Carnauba wax	5.0
Propylene glycol	10.0
Total	100.0

A 13.4-gram portion of a dry blend of the ingredients was tested as described in Example 2. Results, given in the table below, demonstrate a statistically significant improvement in crispness for samples treated with the crisping agent.

Test temperature, °F	Time	Score
15	7 weeks	4.6
0	1 month	6.8
0	3 months	6.5
0	6 months	5.7

Example 5

Batter-Enrobed Chicken Tenders with Crisping Agent

Ingredient	Weight percent
Hydroxypropyl methylcellulose	79.5
Hydrogenated canola oil	10.0
Sorbitol	10.0
Tween-80	0.5
Total	100.0

A 13.4-gram portion of a dry blend of the ingredients was tested as described in Example 2. Evaluation against a control as described in Example 2 after 1 month at 0°F gave a crispness score of 6.1, demonstrating a statistically significant improvement in crispness for samples treated with the crisping agent.

Example 6

Batter-Enrobed Chicken Tenders with Crisping Agent

Ingredient	Weight percent
Hydroxypropyl methylcellulose	79.5
Hydrogenated canola oil	10.0
Glycerol	10.0
Tween-80	0.5
Total	100.0

A 13.4-gram portion of a dry blend of the ingredients was tested as described in Example 2. Evaluation against a control as described in Example 2 after 7 weeks at 15°F gave a crispness score of 5.9, demonstrating a statistically significant improvement in crispness for samples treated with the crisping agent.

Example 7

Batter-Enrobed Chicken Tenders with Crisping Agent

Ingredient	Weight percent
Hydroxypropyl methylcellulose	40.0
Shellac	40.0
Carnauba wax	19.9
Tween-80	0.1
Total	100.0

A 13.4-gram portion of a dry blend of the ingredients was tested as described in Example 2. Evaluation against a control as described in Example 2 after 1 month at 0°F gave a crispness score of 5.6, demonstrating a statistically significant improvement in crispness for samples treated with the crisping agent.

Example 8

Batter-Enrobed Chicken Tenders with Untreated Crumbs

A batter was made by adding 500 milliliters of water to 300 grams of dry batter mix (Newly Weds Foods Inc. B21545), and stirring to give a smooth batter. Pre-sized thawed chicken tenders (20-26 grams) were predusted by dredging in dry batter mix, then coated with batter by dipping into the batter and allowing the excess to drain. Bread crumbs (Newly Weds J Crumb #6001) were then applied by covering all sides of the tender with excess crumb, pressing lightly using hand pressure to firmly attach crumb, and gently shaking to remove excess crumb. The tenders were fry cooked in canola oil for 60-65 seconds at 375°F, drained, placed on paper towels, allowed to cool to room temperature for 15-20 minutes, and sealed into Ziploc® freezer bags. The bags containing tenders were put into a freezer maintained at 0°F. They were stored frozen for a period of 5 days, during which they were removed twice, each time being allowed to thaw for 45 minutes at room temperature then returned to the freezer.

Example 9

Batter-Enrobed Chicken Tenders with Crumbs Treated with 0.80% Gelatin

A batter was made by adding 500 milliliters of water to 300 grams of dry batter mix (Newly Weds Foods Inc. B21545), and stirring to give a smooth batter. Pre-sized thawed chicken tenders (20-26 grams) were predusted by dredging in dry batter mix, then coated with batter by dipping into the batter and allowing the excess to drain. In a Kitchen Aid® mixer with a wire whip head, a solution of 4.8 grams of gelatin (Hormel Polypro 5000) in 150 milliliters of water was added with gently stirring to 600 grams of bread crumbs (Newly Weds J Crumb #6001) during a period of about 2 minutes, and stirring was continued for 10 minutes. The damp crumbs were spread out in two 11 x 16 inch trays and dried for about 1.75 hours in a forced air convection oven at 250°F. The treated crumbs were applied to the batter-coated chicken tenders by covering all sides of the tenders with excess crumb, pressing lightly using hand pressure to firmly attach crumb, and gently shaking to remove excess crumb. The tenders were cooked and stored as described in Example 8. After the 5-day storage

period, the tenders with treated crumbs and controls prepared as described in Example 8 were thawed, heated in a microwave oven, and evaluated for crispness by a trained 10-member panel. Controls were assigned a crispness score of 5.0 on a scale of 0-9. The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 5.4.

Example 10

Batter-Enrobed Chicken Tenders with Crumbs Treated with 1% Whey Protein

In a Kitchen Aid® mixer with a wire whip head, a solution of 6.0 grams of BiPro 95 whey protein concentrate in 150 milliliters of water was added with gentle stirring to 600 grams of bread crumbs (Newly Weds J Crumb #6001) during a period of about 2 minutes, and stirring was continued for 10 minutes. The crumbs were dried and applied to batter-coated chicken tenders, and the tenders fry cooked, frozen, stored, and evaluated as described in Example 9. The treated tenders were judged significantly more crisp than controls, receiving a score of 5.8.

Example 11

Batter-Enrobed Chicken Tender with Crumbs Treated with 0.5% Gelatin and 0.5% Whey Protein

In a Kitchen Aid® mixer with a wire whip head, a solution of 3.0 grams of gelatin (Hormel Polypro 5000) and 3.0 grams of BiPro 95 whey protein concentrate in 150 milliliters of water was added with gentle stirring to 600 grams of bread crumbs (Newly Weds J Crumb #6001) during a period of about 2 minutes, and stirring was continued for 10 minutes. The crumbs were dried and applied to batter-coated chicken tenders, and the tenders fry cooked, frozen, stored, and evaluated as described in Example 9. The treated tenders were judged significantly more crisp than controls, receiving a score of 5.5.

Example 12

Batter-Enrobed Chicken Tenders with Crumbs Treated with 0.8% Gelatin and 1.0% Whey Proteins

In a Kitchen Aid® mixer with a wire whip head, a solution of 4.8 grams of gelatin (Hormel Polypro 5000) and 6.0 grams of BiPro 95 whey protein concentrate in 150 milliliters of water was added with gentle stirring to 600 grams of bread crumbs (Newly Weds J Crumb #6001) during a period of about 2 minutes, and stirring was continued for 10 minutes. The crumbs were dried and applied to batter-coated chicken tenders,

and the tenders fry cooked, frozen, stored, and evaluated as described in Example 9. The treated tenders were judged significantly more crisp than controls, receiving a score of 6.5.

Example 13

Crumbs Treated with 10% Shellac Solution

One hundred grams of puffed rice crumbs were soaked in 500 grams of a 10% solution of shellac (Kane International Shellac #83 confectionery glaze) in ethanol, isolated by filtration, and dried overnight in an nitrogen-purged vacuum oven at 45°C. The treated crumbs and an untreated control were allowed to stand in a beaker of water for 17 minutes, than evaluated for crispness. The untreated crumbs were waterlogged and soggy, while the treated crumbs retained their integrity and crispness.

Example 14

Crumbs Treated with 30% Shellac Solution

One hundred grams of puffed rice crumbs were soaked in 500 grams of a 30% solution of shellac (Kane International Shellac #83 confectionery glaze) in ethanol, isolated by filtration, and dried overnight in a nitrogen-purged vacuum oven at 45°C. The treated crumbs and an untreated control were allowed to stand in a beaker of water for 20 minutes, then evaluated for crispness. The untreated crumbs were waterlogged and soggy, while the treated crumbs retained their integrity and crispness.

Example 15

Crumbs Treated with Shellac and Coconut Oil

One hundred grams of puffed rice crumbs were soaked in 500 grams of a solution of 10% coconut oil and 30% shellac (Kane International Shellac #83 confectionery glaze) in ethanol, isolated by filtration, and dried overnight in a nitrogen-purged vacuum oven at 45°C. The treated crumbs and an untreated control were allowed to stand in a beaker of water for 20 minutes, then evaluated for crispness. The untreated crumbs were waterlogged and soggy, while the treated crumbs retained their integrity and crispness.

Example 16

Batter-Enrobed Chicken Tenders with Crumbs Treated with Gelatin and Whey Proteins

In a Kitchen Aid® mixer with a wire whip head, 200 milliliters of a solution of 3.15% gelatin (Hormel Polypro 5000) and 3.85% BiPro 95 whey protein concentrate,

adjusted to pH 8.0 with 10% sodium hydroxide solution, was added with gentle stirring to 600 grams of bread crumbs (B&B Company J Crumb #2-224-1), and stirring was continued until moisture distribution appeared to be uniform. The crumbs were dried for 1 to 2 hours at 150°F and applied to batter-coated chicken tenders. The tenders were fry cooked, frozen, and stored for a period of one week, during which they were removed twice, each time being allowed to thaw at room temperature then returned to the freezer. Controls with untreated crumbs were prepared and stored the same way. After the storage period, the tenders were thawed, heated in a microwave oven, and evaluated for crispness by a trained 10-member panel. Controls were assigned a crispness score of 5.0 on a scale of 0-9. The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 5.8.

Example 17

Batter-Enrobed Chicken Tenders with Crumbs

Treated with Gelatin and Wheat Protein

Chicken tenders were prepared, cooked, stored, and evaluated as described in Example 16, except that the crumb treatment solution contained 3.15% gelatin (Hormel Polypro 5000) and 3.85% wheat protein (Ogilvie Mills Whetpro 80). The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 6.9.

Example 18

Batter-Enrobed Chicken Tenders with Crumbs

Treated with Gelatin and Rice Protein

Chicken tenders were prepared, cooked, stored, and evaluated as described in Example 16, except that the crumb treatment solution contained 3.15% gelatin (Hormel Polypro 5000) and 3.85% rice protein (Zumbro Insta10). The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 6.1.

Example 19

Batter-Enrobed Chicken Tenders with Crumbs

Treated with Gelatin and Rice Protein

Chicken tenders were prepared, cooked, stored, and evaluated as described in Example 16, except that the crumb treatment solution contained 2.10% gelatin (Hormel Polypro 5000) and 4.90% rice protein (Zumbro Insta10). The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 6.2.

Example 20

Batter-Enrobed Chicken Tenders with Crumbs

Treated with Gelatin and Egg Albumen

Chicken tenders were prepared, cooked, stored, and evaluated as described in Example 16, except that the crumb treatment solution contained 3.15% gelatin (Hormel Polypro 5000) and 3.85% Clofine egg albumen. The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 5.6.

Example 21

Batter-Enrobed Chicken Tenders with Crumbs

Treated with Gelatin and Caseinate

Chicken tenders were prepared, cooked, stored, and evaluated as described in Example 16, except that the crumb treatment solution contained 3.15% gelatin (Hormel Polypro 5000) and 3.85% Ecco 348 sodium caseinate. The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 6.5.

Example 22

Batter-Enrobed Chicken Tenders with Crumbs

Treated with Gelatin and Caseinate

Chicken tenders were prepared, cooked, stored, and evaluated as described in Example 16, except that the crumb treatment solution contained 4.90% gelatin (Hormel Polypro 5000) and 2.10% Ecco 348 sodium caseinate. The tenders with treated crumbs were judged significantly more crisp than controls, receiving a score of 6.4.

Example 23

Breaded Battered Chicken Tenders

Treated After Frying with a Solution of

Shellac, Wax, and Hydroxypropyl Methylcellulose

A coating solution was prepared by dissolving 40 grams of hydroxypropyl methylcellulose, 40 grams of shellac (Kane International Shellac #83 confectionery glaze), 20 grams of carnauba wax, and 0.1 gram of Tween 20 in 900 grams of ethanol. Chicken tenders were battered, breaded, fry cooked, drained and cooled as described in Example 8, and dipped into the coating solution. Ethanol was evaporated by heating the tenders in a microwave oven for 5 minutes, then allowing them to stand at room temperature for 1 hour. The treated tenders and untreated controls were sealed into Ziploc® freezer bags. The bags containing tenders were put into a freezer maintained

at 15°F and arranged to allow freezer air to contact all sides of the bags until completely frozen (24-48 hours). They were stored frozen for a period of 3 weeks, then thawed, heated in a microwave oven, and evaluated for crispness by a trained 10-member panel. Controls were assigned a crispness score of 5.0 on a scale of 0-9. The treated tenders were judged significantly more crisp than controls, receiving a score of 5.7.

Example 24

Thermal Imaging of a Gelatin - Wheat Protein Film

A 10-milliliter aliquot of an aqueous solution of 3.15% gelatin (Hormel Polypro 5000) and 3.85% deglutenized wheat protein (De Melkindustrie Veghel bv Gem 100) was cast onto a glass plate, allowed to air dry overnight, and heated to 250°F for 20 minutes to complete the drying process. The film was removed from the glass plate and transferred to a plastic dish in a microwave oven. The temperature of the film was monitored with an Inframetrics Model 760 infrared imaging camera during application of microwave energy. Within about 30 seconds after the microwave oven had been turned on, the film had reached a temperature of 260°F. In confirmation of the high temperature indicated by thermal imaging, a slight deformation (i.e., softening) of the plastic dish was observed directly below the film.

Example 25

Breaded Battered Chicken Tenders Treated After Frying with and Aqueous Slurry of Methylcellulose, Rice Flour, and Tapioca Dextrin

A dry crisping composition was prepared by mixing the following ingredients:

Ingredient	Weight, grams
Methylcellulose	2.0
Rice flour	10.0
Tapioca dextrin	18.0
Caramel (Sethness RT-175)	0.036
Annatto food color	0.036

With rapid stirring, 20 grams of the resulting powder was added to 40 grams of water. Stirring was continued for 15 minutes to produce a brown slurry. Portions of the slurry were brushed onto both sides of freshly fried battered, breaded chicken tenders. The treated tenders were then dried by exposing each side for 2 minutes to

a heat gun 12 inches above the surface, then cooked in a microwave oven for 2 minutes. The cooked tenders were judged to be more crisp than untreated controls.

Example 26

Breaded Battered Chicken Tenders Treated After Frying with a Dry Mixture of Methylcellulose, Rice Flour, and Tapioca Dextrin, then Water

The dry crisping composition of Example 25 was dusted onto freshly fried battered, breaded chicken tenders. The tenders were lightly sprayed with water, then dried and cooked as described in Example 25. The cooked tenders were judged to be more crisp than untreated controls.

Example 27

Chicken Tenders Enrobed with Tempura Batter Containing Crisping Agent

Ingredient	Weight percent
Potassium kappa-carrageenan	0.17
Calcium iota-carrageenan	0.17
Locust bean gum	0.33
Rice bran wax	2.7
Stearic/palmitic acid (1:1 mixture)	1.7
Rice starch	21.6
Flour	5.0
Salt	1.7
Water	66.7
Total	100.07

The water was heated to 100°C. In a blender with stirring at high speed, the dry ingredients were added to the hot water, and stirring was continued for several minutes to form a batter. Pre-sized thawed chicken tenders (20-26 grams) were coated by dipping into the batter and allowing the excess to drain. The tenders were fry cooked in canola oil for 60-65 seconds at 375°F, drained, placed on paper towels, allowed to cool to room temperature for 15-20 minutes, and sealed into Ziploc® freezer bags. The bags containing tenders were put into a freezer maintained at 15°F. They were allowed to freeze, then stored frozen. Until the bags were completely frozen (24-28 hours), they were arranged to allow freezer air to contact all sides. At each test time, a bag was thawed, heated in a microwave oven, and evaluated for crispness by

a trained 10-member panel against controls which had been prepared as described in Example 1 and stored, thawed, and heated under the same conditions. Crispness was rated on a scale of 0-9, with the controls assigned a score of 5.0. Results, given in the table below, demonstrate improved crispness for samples treated with batter containing crisping agent.

Time	Score
3 weeks	5.3
5 weeks	5.4
7 weeks	5.3

Example 28

Chicken Tenders Enrobed with Tempura Batter Containing Crisping Agent, Leavening, and Treated Bread Crumbs

Ingredient	Weight percent
Carnauba wax	0.8
Hydroxypropyl methylcellulose	1.25
Stearic/palmitic acid (1:1 mixture)	0.17
Propylene glycol	0.17
High amylose starch	22.0
Egg whites	11.0
Nonfat dry milk	2.4
Dextrose	1.7
Sodium acid pyrophosphate	0.3
Sodium bicarbonate	0.2
Salt	0.8
Water	59.2
Total	100.0

The water was heated to 100°C. In a blender with stirring at high speed, the dry ingredients were added to the hot water, and stirring was continued for several minutes. To 100 grams of the resulting batter, 30 grams of treated bread crumbs prepared as described in Example 12 were added with stirring. Pre-sized thawed chicken tenders (20-26 grams) were coated by dipping into the batter and allowing the excess to drain. The tenders were fry cooked in canola oil for 60-65 seconds at 375°F,

drained, placed on paper towels, allowed to cool to room temperature for 15-20 minutes, and sealed into Ziploc® freezer bags. The bags containing tenders were put into two freezers, one maintained at 15°F, the other at 0°F. They were allowed to freeze, then stored frozen. Until the bags were completely frozen (24-48 hours), they were arranged to allow freezer air to contact all sides. At each test time, a bag was thawed, heated in a microwave oven, and evaluated for crispness by a trained 10-member panel against controls which had been prepared as described in Example 1 and stored, thawed, and heated under the same conditions. Crispness was rated on a scale of 0-9, with the controls assigned a score of 5.0. Results, given in the table below, demonstrate a statistically significant improvement in crispness for samples treated with batter containing crisping agent.

Test temperature, °F	Time	Score
15	7 weeks	6.2
0	1 month	6.7
0	3 months	7.0
0	6 months	5.2

Example 29

Breaded Battered Chicken Tenders Treated After Frying with a Gum Arabic-Protein-Oil Emulsion

Ingredient	Weight, grams
Water	50.0
Whey protein concentrate	2.5
Tween 80 emulsifier	1.0
Wesson vegetable oil	5.0
Egg albumen (Clofine Dairy Products, Inc.)	2.0
Gum arabic	1.0

In a blender running at low speed, the ingredients were added to the water in the order listed, and blending was continued for 5 minutes. The resulting emulsion was brushed onto thawed commercial frozen breaded chicken breast patties, and the treated patties were cooked in a microwave oven for 3 minutes. The cooked patties were crisp, but had an unappealing white appearance.

Example 30

Breaded Battered Chicken Tenders Treated After Frying with a Gelatin-Egg White-Oil Emulsion

Ingredient	Weight, grams
2 egg whites	~60
Salt	0.5
Wesson vegetable oil	5.0
Tween 80 emulsifier	0.2
Caramel color	0.5
Gelatin	0.3

In a blender running at low speed, the salt, oil, and emulsifier were added to the egg whites. The mixture was blended gently, the caramel color and gelatin were added, and blending was continued for a few minutes. The resulting brown emulsion was centrifuged for 15 minutes at 14000 rpm to remove a small amount of particulate material, then brushed onto thawed commercial frozen breaded chicken breast patties. The treated patties were cooked for 2 minutes in a microwave oven. The cooked patties were crisp and had an appealing golden brown color.

Example 31

Breaded Battered Chicken Tenders Treated After Frying with a Gelatin-Protein-Oil Emulsion

Ingredient	Weight, grams
Water	90.0
Egg albumen (Clofine Dairy Products, Inc.	10.0
Wesson vegetable oil	5.0
Tween 80 emulsifier	0.2
Caramel color	0.5
Gelatin	0.3

In a blender running at low speed, the water and egg albumen were mixed gently, the oil and emulsifier were added with continued stirring, the caramel color and gelatin were added, and stirring was continued for about 5 minutes. The resulting

brown emulsion was centrifuged for 15 minutes at 14000 rpm to remove a small amount of particulate material, then brushed onto thawed commercial frozen breaded chicken breast patties. The treated patties and untreated controls were cooked in a microwave oven for 3 minutes. The controls were pale in color. The treated patties had an appealing golden brown color and were substantially more crisp.

Example 32

Breaded Battered Chicken Tenders Treated After Frying with a Gelatin-Protein-Oil Emulsion

Ingredient	Weight, grams
Water	80.0
Egg albumen (Clofine Dairy Products, Inc.	20.0
Wesson vegetable oil	10.0
Tween 80 emulsifier	0.2
Caramel color	0.5
Sodium alginate	0.5

The ingredients were mixed in a blender running at low speed, and blending was continued until the mixture was homogenous. The resulting brown emulsion was brushed onto thawed commercial frozen breaded chicken breast patties. The treated patties were cooked in a microwave oven for 2.5 minutes. The cooked patties were crisp and had an appealing golden brown color.

CLAIMS

1. An edible food coating composition comprising

(a) from about 50 to about 95 weight percent of a film forming composition, and

(b) from about 5 to about 50 weight percent of a hydrophobic composition, said coating composition when incorporated in a batter mix imparting a crisp surface to foods upon cooking of said foods.

2. A composition according to claim 1 wherein said film forming composition is present at from about 50 to about 90 percent by weight; said hydrophobic composition is present at from about 10 to about 25 percent by weight; said film forming composition selected from the group consisting of hydroxypropyl methylcellulose, hydroxypropylcellulose, methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and zein; and combinations thereof; and said hydrophobic composition selected from the group consisting of fats, fatty acids, waxes and petroleum waxes; and combinations thereof.

3. A composition according to claim 1 further comprising a water binding composition, said water binding composition present at a concentration of from about 2 to about 5 weight percent, said water binding composition selected from the group consisting of soluble carbohydrates, insoluble carbohydrates, polyols, proteins, inorganic salts, organic acids, salts of organic acids; and combinations thereof.

4. A composition according to claim 1 further comprising a plasticizer,

said plasticizer present at a concentration of from about 7 to about 12 weight percent, said plasticizer selected from the group consisting of glycerol, propylene glycol and polypropylene glycol; and combinations thereof.

5. A composition according to claim 1 further comprising an emulsifier,

said emulsifier present at a concentration of from about 1 to about 12 weight percent; said emulsifier selected from the group consisting of propylene glycol, lecithins, monoglycerides, diglycerides, diacetyltartaric acid esters of monoglycerides, diacetyltartaric acid esters of diglycerides, monosodium phosphate derivatives of monoglycerides, monosodium phosphate derivatives of diglycerides, polyol fatty acid esters, sorbitan fatty acid esters, polyoxyethylene monoglycerides, polyoxyethylene diglycerides, polyoxyethylene sorbitan fatty acid esters, sucrose fatty acid esters, esters

of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty acids, esters of acids selected from the group consisting of fumaric, lactic, tartaric or citric with fatty alcohols, esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic, or succinic with monoglycerides, and esters of acids selected from the group consisting of fumaric, lactic, tartaric, citric, acetic or succinic with diglycerides; and combinations thereof.

6. A composition according to claim 1 further comprising a viscosifying agent, said viscosifying agent present at a concentration of from 0.05 to about 5 percent, said viscosifying agent selected from the group consisting of xanthan gum, guar gum, starches, gelatin, pectin, agar, carrageenans, alginates, locust bean gum, methyl cellulose, hydroxypropylcellulose, hydroxypropylmethyl cellulose, carboxymethyl cellulose, ethyl cellulose and methylethyl cellulose; and combinations thereof.

7. A batter mix containing the composition of claim 1.

8. A foodstuff coated with the batter mix of claim 7, said foodstuff selected from the group consisting of meats, poultry, baked goods, fish, vegetables and cheeses.

9. A process for imparting a crisp surface to a foodstuff comprising

(a) applying a crisping composition to said foodstuff, said crisping composition comprising

(i) from about 50 to about 95 weight percent of a film forming composition, and

(ii) from about 5 to about 50 weight percent of a hydrophobic composition, said crisping composition incorporated into a batter mix, and

(b) cooking said foodstuff.

10. A process according to claim 9 wherein said crispness improving composition further comprises a) a water binding composition, b) a plasticizer, and c) an emulsifier.

11. A bread crumb composition which when applied to a food surface prepared to receive said crumbs imparts a crisp surface to said food upon cooking, said bread crumb composition comprising a bread crumb impregnated with a crispness improving composition selected from the group consisting of proteins, gelatin, flour, starches, dextrins, waxes, shellac and polysaccharides; and combinations thereof.

12. A bread crumb composition according to claim 11 wherein said protein is selected from the group consisting of whey proteins, corn proteins, rice proteins, wheat proteins, and animal proteins; and combinations thereof.

13. A batter mix containing the bread crumb composition of claim 11.

14. A foodstuff comprising the bread crumb composition of claim 11.

15. A method for improving the crispness of bread crumbs comprising

(a) treating said crumbs with an aqueous solution or dispersion of a crispness improving composition, said crispness improving composition comprising one or more substances selected from the group consisting of proteins, gelatin, flour, starches, dextrins, shellac, waxes, and polysaccharides, and combinations thereof.

(b) substantially drying the treated crumbs,

(c) applying said treated crumbs to a food, and

(d) cooking said food.

16. A method according to claim 15 wherein said crispness improving composition further comprises a fat or an oil.

17. A process for imparting a crisp surface to a foodstuff comprising

(a) preparing a surface of said foodstuff to receive a bread crumb composition;

(b) applying a bread crumb composition to said surface, said bread crumb composition comprising a bread crumb impregnated with a crispness improving composition, said crispness improving composition comprising one or more substances selected from the group consisting of proteins, gelatin, flour, starches, dextrins, shellac, waxes and polysaccharides; and combinations thereof, and

(c) cooking said foodstuff.

18. A process according to claim 17 wherein said crispness improving composition further comprises a fat or an oil.

19. A process for imparting a crisp surface to a foodstuff comprising

(a) preparing a surface of said foodstuff to receive a bread crumb composition;

(b) applying a bread crumb composition to said surface;

(c) treating said food with an aqueous solution or dispersion of a crispness improving composition, said crispness improving composition selected from the group

consisting of proteins, gelatin, flour, starches, dextrins, waxes, shellac, and polysaccharides, and combinations thereof, and

(d) cooking said foodstuff.

20. A process according to claim 9 wherein said crispness improving composition further comprises a fat or an oil.

21. A process for imparting a crisp surface to a battered, breaded, or battered and breaded food comprising

(a) cooking or partially cooking said foodstuff;

(b) treating said food with an aqueous solution or dispersion of a crispness improving composition, said crispness improving composition comprising one or more substances selected from the group consisting of proteins, flour, starches, dextrins, gelatin, shellac, waxes, and polysaccharides; and combinations thereof, and

(c) substantially drying the surface of said foodstuff.

22. The process according to claim 21 wherein said crispness improving composition comprises a starchy composition said starchy composition is selected from the group consisting of rice flour, wheat flour, corn flour, potato starch, oat flour, caramelized barley malt, and corn starch, and combinations thereof, and a film-forming composition, said film forming composition is selected from the group consisting of hydroxypropyl methylcellulose, hydroxypropylcellulose, methylcellulose, ethylcellulose, carboxymethylcellulose, guar gum, carrageenans, arabinogalactans, alginates, locust bean gum, xanthan gum, and zein; and combinations thereof.

23. The process according to claim 22 wherein said crispness improving composition further comprises a composition selected from the group consisting of tapioca, dextrin, maltodextrins, polydextrose, and dextrose; and combinations thereof.

INTERNATIONAL SEARCH REPORT

Inte[illegible]onal Application No
PCT/US 93/09271

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 A23P1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 A23P A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO-A-91 06227 (ENZYTECH) 16 May 1991 see claims 1,3,8,11,18,20-23 see page 12, line 31 - page 13, line 25 see page 15, line 31 - page 16, line 15 see page 17, line 8 - line 26	1-10
X	US-A-4 375 484 (C.R. LEE) 1 March 1983 see column 2, line 60 - column 3, line 14 see column 4, line 43 - line 54 see column 5, line 20 - line 45	1-3,5-9
X	GB-A-840 154 (DOW CHEMICAL CO.) 6 July 1960 see claim 1 see page 3, line 107 - line 117	1-4
X	EP-A-0 048 123 (MERCK & CO.) 24 March 1982 see page 3, line 17 - line 22	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

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Date of the actual completion of the international search
18 January 1994

Date of mailing of the international search report
29.03.94

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INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 93/09271

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US-A-3 255 021 (R.D. EARLE) 7 June 1966 see column 2, line 9 - column 3, line 2 ---	1
X	BE-A-691 735 (SERAC) 29 May 1967 see page 4, line 15 - page 5, line 12 ---	1
A	WO-A-86 00501 (WISCONSIN ALUMNI RESEARCH FOUNDATION) 30 January 1986 see page 4, line 31 - page 5, line 20 see page 6, line 11 - line 30 ---	1-4
A	US-A-3 323 922 (J.R. DURST) 6 June 1967 see claims 1,2,8 see column 1, line 50 - column 2, line 54 -----	1-4

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 93/09271

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

For further information please see form PCT/ISA/206 dated 10.02.1994.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searches without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-10

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/US 93/09271

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9106227	16-05-91	US-A- 5182130	26-01-93
US-A-4375484	01-03-83	CA-A- 1160900	24-01-84
GB-A-840154		NONE	
EP-A-0048123	24-03-82	NONE	
US-A-3255021		NONE	
BE-A-691735	29-05-67	FR-A- 1474787 NL-A- 6617662	26-06-67
WO-A-8600501	30-01-86	AU-A- 4604385 CA-A- 1267806 EP-A- 0188553 JP-T- 61502794 US-A- 4915971	10-02-86 17-04-90 30-07-86 04-12-86 10-04-90
US-A-3323922		NONE	